Ch. 10 and 11

Ideal Gas - a gas that behaves accordingly to the Kinetic Molecular Theory (KMT)

↳ KMT

1. All Samples of the gas consists of large numbers of tiny particles.
2. Particles are in a constant state of motion
3. Particles undergo elastic collisions (no energy lost)

* 4. No attractive forces between gas particles

5. Kinetic Energy is directly proportionate to temperature.
   ↳ KE ↑ → Temp. ↑

Basic Gas Properties:

- Diffusion - Spreading of a gas in the absence of air Currents

Expansion/Compression

Low Density - $\frac{g}{L}$

Fluidity - Particles Can easily glide past eachother (Pourable)

Behaviors of Gases

↳ 4 variables of gases:

- Pressure (P) - Collisions that gas particles make with walls.
  $P = \frac{Force}{Area}$
- Temperature (T) - Average Kinetic Energy (How fast Particles move)
- Volume (V) - Space gas particles occupy
- Moles (n) - Number of particles

Qualitative Behaviors of Gases

P vs. T @ Constant n+V

As T goes up, P goes up because as particles move faster, they collide more so P goes up.

P vs. V @ constant T+n

If V goes up, P goes down because in a larger space the number of collisions decrease so P goes down.

V vs. T @ Constant P+n
As T goes up, V goes up because as particles move faster, they spread out and occupy a large[r]
V
P vs. n @ constant V+T
As n goes up, P goes up because more particles will have more collisions, so more P
V vs. n @ Constant T+P
If n goes up, V goes up because more particles occupy more space.
Measuring Pressure
In 1643 Torricelli measured atmospheric pressure with a Hg (mercury) Barometer.
Barometer: Measures how far the atmospheric press[ure] pushes the Hg up the tube.
Standard P = 760 mmHg = 760 torr = 1.0 atm (atmos[phere])
101.3 KPa (kilo pascals)

- 800 torr = ___?___ atm
  $800 \text{ torr} \times \frac{1 \text{ atm}}{760 \text{ torr}} = 1.04 \text{ atm}$
- 0.95 atm = ___?___ KPa
  $0.95 \text{ atm} \times \frac{101.3 \text{ KPa}}{1 \text{ atm}} = 96.2 \text{ KPa}$
- 152 KPa = ___?___ mmHg
  $152 \text{ KPa} \times \frac{760 \text{ mmHg}}{101.3 \text{ KPa}} = 1140 \text{ mmHg}$

Boyle's Law
If V doubles, P decreases by half (viceversa)
- Inverse proportion between V+P

$V \cdot P = K$
K = constant
ex: (20 mL)(30.3 inHg) = 606
(40 mL)(15.15 inHg) = 606
$V_1 \cdot P_1 = V_2 \cdot P_2$

Charles' Law 1787

V vs. T

$V\uparrow \rightarrow T\uparrow$ (Direct Proportion)

- If $T\uparrow$ by 1, $V\uparrow$ by $\frac{1}{273}$

Inverse – $xy = k$

Direct – $y = kx$

ex: $\frac{V_1}{T_1} = k(P+n)$

$\frac{V_2}{T_2} = k$

$\frac{V_1}{T_1} = \frac{V_2}{T_2} \rightarrow$

Charles' Law

$V_1T_2 = V_2T_1$

T must be in Kelvin

$K = °C + 273$

Gay-Lussac's Law

$P_1T_2 = P_2T_1$

Combined Gas Law

$V_1P_1T_2 = V_2P_2T_1$

T = Kelvin

STP

standard temp and pressure